

REMARKS/ARGUMENTS

In response to the Office Action mailed August 3, 2004, applicants would request reconsideration. The Office Action indicates that claims 10-12 are withdrawn. This is believed to be in error.

Claims 5-6 and 10-12 are pending in this application. They all claim a method of conducting a water-gas shift reaction utilizing a molybdenum carbide catalyst having a surface area of at least $77 \text{ m}^2/\text{g}$. These claims were rejected under 35 USC §112 and 35 USC §103(a).

With respect to the rejection under 35 USC §112, the Examiner objected to the limitations "having a surface area at least $77 \text{ m}^2/\text{g}$ with respect to claim 5, and "a surface area greater than $90 \text{ m}^2/\text{g}$ " with respect to claim 6. The Examiner correctly pointed out that Example 10 discloses $77 \text{ m}^2/\text{g}$, but maintains that it would not provide basis for at least $77 \text{ m}^2/\text{g}$.

Applicants would disagree with the Examiner's position. The law does not require that those exact words be in the specification, it merely requires that the specification provide that information to those skilled in the art. In other words, if one of ordinary skill in the art would read the specification, would he realize that applicants were disclosing an invention wherein the surface area of the catalyst was at least $77 \text{ m}^2/\text{g}$? An Example shows $77 \text{ m}^2/\text{g}$, therefore that lower limitation is established. The specification clearly indicates that greater surface area is desired. That provides the limitation for "at least". The fact that a better result is achieved as the surface area increases would

disclose to one skilled in the art that the invention relates to increasing surface area. The abstract specifically references a high surface area material. The specification at page 2 indicates that high surface area is critical. The Summary of the Invention, states that:

More particularly the present invention is premised on the realization that molybdates such as ammonium molybdate can be directly formed into a high surface area molybdenum carbide by direct reaction with a mixture of hydrogen and carbon monoxide and methane.

Later on, it indicates that these are good for use in the water-gas shift reaction. There is no requirement that a claim limitation be recited in the specification *in haec verba*. Section 112 merely requires that one skilled in the art would appreciate this limitation upon reading the specification. Taking the specification in its entirety, it is clear that the greater the surface area, the better the activity. Therefore, this supports the limitations of "at least 77 m²/g", as well as "greater than 90 m²/g". Applicants would accordingly would request reconsideration.

With respect to the rejection based on 35 USC §103, these claims were rejected as unpatentable over Thompson in view of Sherif, Boudart, or Grindatto. Obviously, the water-gas shift reaction is known. However, there is no disclosure that one would achieve significant improvements in going from 54 m²/gm, as shown in Example 10, to 77 m²/gm. Keep in mind that in a catalysis case one is working with an extremely unpredictable situation. None of the references disclose molybdenum carbide having this surface area limitation used to conduct a water-gas shift reaction. Nor is there any suggestion to combine these to arrive at applicants' invention with the expectation of

success. For example, the Boudart reference discloses the formation of high surface area carbides and nitrides. It does not disclose the use of this for a water-gas shift reaction. Further, it does not disclose a carbide having a specific area of greater than 77 m²/gm. It does disclose formation of a nitride having 188 m²/gm, but, presumably, this would not be an effective catalyst for the water-gas shift reaction. It discloses a carbide having 51 m²/gm, and claims that this falls within the invention. This teaches away from the present invention.

The Sherif reference also fails to disclose use of the MoC₂ catalyst for a water-gas shift reaction. Here they reference carbides having high surface areas with catalytic activity for pollution control isomerization and hydrosulfurization. But, again, there is no disclosure whatsoever of utilization of this in a water-gas shift reaction, or that one would see improvements, particularly, as applicants have pointed out, going from 54 m²/gm to 77 m²/gm. The same argument applies with respect to the disclosure in the Grindatto reference.

Further, although the general description in Sherif refers to molybdenum carbide, only Example 14 specifically discloses molybdenum carbide and further discloses the formed composition has a surface of 55 m²/gm. This apparently is acceptable under the disclosure of the Sherif patent. Accordingly, it is actually teaching away from the present invention when one considers the reference in its entirety.

What all of these references lack is any suggestion of combining the disclosures in any of these prior three references with the Thompson reference (which

does not place an importance on surface area) to arrive at applicants' invention. None of the secondary references even suggest the use of an MoC_2 catalyst for a water-gas shift reaction. In light of the extreme unpredictability in the catalyst art, applicants would maintain that there is simply no indication that using the high surface area molybdenum carbide in the water-gas shift reaction would improve results, particularly when one is going from a relatively high surface area of $55 \text{ m}^2/\text{gm}$ to $77 \text{ m}^2/\text{gm}$, and achieving significantly improved results.

In light of the above, applicants would request reconsideration of the outstanding rejections, and allowance of the claims.

Respectfully submitted,

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